



# Bank Competition and Credit Constraints in Developing Countries: New Evidence

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Florian Leon. Bank Competition and Credit Constraints in Developing Countries: New Evidence. 2014. halshs-01015806

**HAL Id: halshs-01015806**

**<https://shs.hal.science/halshs-01015806>**

Preprint submitted on 27 Jun 2014

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**Bank Competition and Credit Constraints in Developing Countries :  
New Evidence**

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*Etudes et Documents n° 13*

Juin, 2014

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Directeur de la publication : Vianney Dequiedt  
Directeur de la rédaction : Catherine Araujo Bonjean  
Responsable d'édition : Annie Cohade  
ISSN : 2114 - 7957

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## **Abstract**

Whether competition helps or hinders small firms' access to finance is in itself a much debated question in the economic literature and in policy circles, especially in the developing world. Economic theory offers conflicting predictions and empirical contributions provide mixed results. This paper considers the consequences of inter-bank competition on credit constraints using firm level data covering 70 developing and emerging countries. In addition to the classical concentration measures, competition is assessed by computing three non-structural measures (Lerner index, Boone indicator, and H-statistics). The results show that bank competition alleviates credit constraints, while bank concentration measures are not robust predictors of a firm's access to finance. Findings highlight that bank competition not only leads to less severe loan approval decisions but also reduces borrowers' discouragement. In addition, a secondary result of this paper documents that banking competition enhances credit availability more by reducing prices than by increasing relationship lending.

**Mots clés / Key words :** Bank competition, access to credit, developing countries, discouraged borrower

**Code JEL / JEL classification :** G20, L1

**Acknowledgement / Remerciements :** We are grateful to Pierrick Baraton, Vianney Dequiedt, Samuel Guérineau, Lars Norden and Alexandre Sauquet, as well as participants at the 3rd CInSt Banking Workshop (Moscow, November 2013) and ADRES Doctoral conference (Paris, February 2014) for useful comments.

# 1 Introduction

Limited access to bank credit is viewed by many policy makers and academics as a major growth constraint for developing economies, in particular for small- and medium-sized enterprises (Beck and Demirguc-Kunt, 2006; Ayyagari et al., 2008). As a result, many resources have been devoted to improving credit availability around the world. Meanwhile, banking industry structures in developing countries have undergone major transformations. Competition in the banking sector may be an important driver of access to credit. The impact of competition on credit availability is then a crucial policy and academic question. Economic theory makes conflicting predictions. The traditional *market power view* argues that market power is detrimental in banking as well as in other industries. As a result, fiercer competition leads to lower costs and better access to finance (Besanko and Thakor, 1992; Guzman, 2000). In the presence of information asymmetries and agency costs, however, competition can reduce access by depriving banks of the incentive to build lending relationship (Petersen and Rajan, 1995).<sup>1</sup> Other contributions document that the quality of screening (Broecker, 1990; Marquez, 2002) and banks' incentives to invest in information acquisition technologies (Hauswald and Marquez, 2006) are higher in less competitive markets. Therefore, the *information hypothesis* argues that access to credit for opaque borrowers can be reduced when competition is harsher.

Which of these views best describes the implications of competition in terms of access to credit is ultimately an empirical issue. Despite the policy relevance of this issue, empirical evidence on the effect of interbank competition on access to finance in developing countries is scarce and largely inconclusive. Using data from 74 developed and developing countries, Beck et al. (2004) show that bank concentration increases the probability that firms report finance as a major obstacle to growth, in line with the market power view. Chong et al. (2013) give support for the market power view in China. González and González (2008), however, document that firms use more external funds in countries with less competitive markets, in line with the information hypothesis.<sup>2</sup> A major concern with these studies

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1. Boot and Thakor (2000), however, document that the role exerted by competition on bank relationships is somewhat inconclusive.

2. The implication of concentration on economic or industrial growth is also inconclusive. Cetorelli and Gambera (2001) give some support for the information hypothesis. Deidda and Fattouh (2005) give

refers to the proxy of competition used. The degree of competition is assessed by market concentration. Several contributions have cast doubt on the consistency and robustness of the structural approach as an indicator of competition in banking. Both the theory of contestability ([Baumol et al., 1983](#)) and the theory of efficient-structure ([Demsetz, 1973](#)) argue that market structure is a weak proxy of market power. Furthermore, concentration may proxy for a whole range of conduct-determining bank and market characteristics, including average bank size and bank complexity in terms of product variety and activity for instance ([Ergungor, 2004](#)). [Carbó-Valverde et al. \(2009b\)](#) document that this issue is not only a technical problem insofar as conclusions may be sensitive to the measure of competition employed.

A recent wave of works has tried to overcome this issue by employing non-structural measures of competition. For instance, [Claessens and Laeven \(2005\)](#) examine the influence of banking competition on economic growth in 16 countries, using the Panzar-Rosse H-statistic as a non-structural approach to indicate market competition. They find that sectors heavily dependent on bank financing grow faster in countries where there is fierce bank competition. [Liu and Mirzaei \(2013\)](#) confirm the market power view by employing the sensitivity of market share to relative costs, an indicator of competition initially proposed by [Hay and Liu \(1997\)](#) and extended by [Boone \(2008\)](#). [Fernández de Guevara and Maudos \(2011\)](#) find opposite evidence that the exercise of market power enhances economic growth, supporting the information hypothesis. They measure competition by employing both the Lerner index and the Panzar-Rosse H-statistic. [Hoxha \(2013\)](#) reaches similar conclusions using the Panzar-Rosse H-statistic. Recent papers directly investigate the relationship between the use of credit and bank competition. Using a panel data analysis on 53 developing countries and the Lerner index as proxy for competition, [Love and Martinez Peria \(2012\)](#) show that the use of bank loan is lower in more competitive markets, giving support for the market power view. However, in a sample of 33 countries, [Mudd \(2013\)](#) obtains a more complex relationship between interbank competition and a firm's probability of having a line of credit. Competition (measured by Panzar-Rosse H-statistics) has a positive but declining effect on a firm's use of bank financing, turning support for the market power hypothesis for low-income countries, while [Fernández et al. \(2010\)](#) show that concentration is not detrimental for growth in countries with weak institutions.

to a negative impact for competitive markets above the mean level.

This paper tests the information hypothesis versus the market power hypothesis in the context of developing countries but also mechanisms by which competition affects credit availability. Econometric analysis considers almost 30,000 firms from 70 developing countries across four continents. Firm-level variables are extracted from World Bank Enterprises Surveys (WBESs) and country-level variables are taken from diverse sources. Using survey responses, firms are divided into four groups according to their credit market experience. The "Non-Borrowers" group assembles firms that did not need credit the previous year. "Discouraged Borrowers" gathers together firms that needed a loan but did not apply. Among the applicants, I distinguish between "Denied Borrowers" who did not receive a loan and "Accepted Borrowers" who did. A firm is declared as financially constrained if it is classified in the "Discouraged Borrowers" or "Denied Borrowers" group. This strategy of distinguishing and grouping firms that were turned down and those discouraged from applying has already been employed by [Popov and Udell \(2012\)](#). Information on bank competition is extracted from the Global Financial Development Database. Competition in the banking industry is assessed by the traditional concentration ratio (the share of assets held by the three largest banks) and three non-structural measures (the Lerner index, Boone indicator, and Panzar-Rosse H-statistic). The effect of bank competition on credit availability is obtained by running a random-effect probit model including a competition measure and controlling for firm- and country-level characteristics. The empirical set-up allows us not only to study the determinants of credit rationing but also the determinants of a firm's decision to apply for a credit and a bank's decision to approve or reject the request. This stage enables us to understand how competition impacts the behaviors of credit market participants. To control for sample selection, a probit with sample selection model is used at this stage.

The results show that financing constraints are alleviated in countries where banking markets are more competitive, irrespective of whether competition is measured by the Boone indicator or the Panzar-Rosse H-statistic, supporting the market power hypothesis. Employing the Lerner index to proxy market power suggests a similar conclusion, while the results are not robust. The degree of concentration has no impact on credit availability. In the second step of the analysis, we investigate the differential impact of

competition on borrowers and lenders. In more competitive markets, firms are less reluctant to apply and the probability of applicants receiving funds is higher. The results show that competition not only leads to less severe loan approval decisions but that is also reduces borrower discouragement. An additional result of this paper documents that banking competition enhances credit availability more by reducing prices than by increasing relationship lending.

This paper makes important contributions to the literature on the relationship between bank competition and credit availability in developing countries by addressing a number of issues that have not yet been resolved. First, to our knowledge, this paper is the first that considers different non-structural measures of competition to investigate the implications of competition on credit availability. Non-structural measures of competition are more relevant than structural measures to proxy competition. However, there is no consensus regarding the best measure by which to gauge competition. The choice of a particular indicator can influence conclusions regarding the implications of competition ([Carbó-Valverde et al., 2009b](#)). By confronting the findings from several non-structural measures, this paper gives a more complete picture of the role of competition on credit availability. In particular, it is the first work to use the Boone indicator to document the linkage between competition and access to credit. Second, the identification of financially constrained firms remains a challenge. Existing studies measure credit constraints by a firm's perception of finance as an obstacle to growth ([Beck et al., 2004](#); [Clarke et al., 2006](#)) or the mix of internal and external funds ([Petersen and Rajan, 1995](#); [González and González, 2008](#); [Carbó-Valverde et al., 2009b](#)). The survey measures are subject to perception bias ([Ergungor, 2004](#)) and the mix of funds requires data on firms' balance sheets, rarely available for SMEs in developing countries. Recent works proxy credit constraints by the use of credit ([Love and Martinez Peria, 2012](#); [Mudd, 2013](#)). The fact that few firms obtain credit is, however, not sufficient to prove constraints, since certain firms may not have a demand for credit. This hypothesis is far from anecdotal in developing countries, more than half of firms had no demand for credit ([Cole and Dietrich, 2012](#)). A comprehensive definition of credit constraints should measure the demand for credit that is unfulfilled by the existing supply of credit due to market imperfections ([Chong et al., 2013](#)). As a result, we classify a firm as constrained if its demand is not fulfilled by the



supply of funds due to market frictions. This includes not only firms whose application was turned down, but also firms who refused to apply in spite of a viable project. Third, this work not only tests the *market power hypothesis* vs. the *information hypothesis* but also tries to understand how competition exerts a differential impact on borrowers and on banks decisions. In addition, we also try to identify the channel by which competition affects credit availability (price channel vs. relationship channel). The final contribution involves to country coverage. The sample considers 70 developing countries including many countries from Africa and other low-income countries.

In addition to its contributions to the literature regarding the impact of bank competition on credit availability in developing countries, this work also adds to the empirical literature on borrower discouragement and approval/denial decisions in developing countries. Empirical studies are generally focused on the U.S. (Cole, 1998; Cavalluzzo et al., 2002; Han et al., 2009; Cole, 2010). Recent contributions have begun to investigate these issues in the case of developing countries (Bigsten et al., 2003; Cole and Dietrich, 2012; Brown et al., 2011; Chakravarty and Xiang, 2013) but often analyze the characteristics of firms or managers to explain a firm's discouragement or a bank's rejection decision. Brown et al. (2011) underline that country characteristics play a significant role in borrower discouragement and in bank decisions to deny in Eastern Europe. Cole and Dietrich (2012) confirm the importance of macroeconomic factors to explain discouragement and denial in the case of 80 developing countries. Taking advantage of the large country coverage, we investigate a large set of country characteristics, including interbank competition. The findings shed light on the important role played by country characteristics to explain borrower discouragement and bank decisions.

The rest of the paper is organized as follows. Section 2 presents the data. Section 3 describes the empirical methodology. The baseline results are discussed in Section 4. Section 5 presents key robustness checks and the final section concludes.

## 2 Data

The database used in this paper combines firm- and country-level data from various sources. The firm-level data come from the World Bank Enterprises Surveys (WBES).

The dataset is supplemented with country-level data from diverse sources such as the World Development Indicators, the Global Financial Development Database, and the Doing Business databases. Some filtering rules are applied. Firms for which information about credit market experience was not available and for whom at least one of the firm- and country-level control variables were not available have been dropped. We then excluded observations when the interviewer did not believe that the responses were reliable (question a16). Finally, firms with more than 5,000 employees that can access equity markets have been excluded. The final sample includes 28,952 firms from 70 low-income and middle income countries spanning four continents (Africa, Latin America, Europe and Asia). Two fifths of the firms were surveyed in 2006 and one third in 2009. Others were surveyed in 2007, 2008 and 2011. The sample considered has the advantage of grouping together economies with heterogeneous characteristics.

## **2.1 Measuring credit constraints**

The survey data collected include quantitative as well as qualitative information. Among other topics, surveys address questions about access to finance. To identify credit constrained firms, we refer to a number of questions regarding the credit experience of the firm in the year previous to the survey. The methodology employed follows previous contributions (Brown et al., 2011; Cole and Dietrich, 2012; Popov and Udell, 2012). The first question is whether or not the firm applied for a loan (*k.16 : In last year, did this establishment apply for loans or lines of credit ?*). In order to distinguish between discouraged borrowers and non-borrowers among non-applicants, we turned to the subsequent question (question k.17) which asks the main reason for not applying. Firms are considered as "Non-Borrowers" if they declared that they did not apply because they did not need a loan. Among the applicants (firms that answered "yes" in question k16), a distinction is made between approved and denied applicants. A firm is declared as approved if at least one request was not turned down. The question k.18 gives the number of applications submitted and the question k.19 the number of applications rejected. A firm is coded as "Approved Borrowers" if the number of applications is larger than the number of applications rejected (and 0 if all applications were rejected). For several countries, we did not

have this information. In such case, we used the question k18a : *"Did the firm apply for any new loans/lines of credit that were rejected in last fiscal year ?"*.<sup>3</sup>

From this classification, we divided firms among financially constrained firms and others. A firm is declared as rationed if it is classified as "Discouraged Borrower" or "Denied Borrower". This measure allows us to identify firms expressing a demand for formal funds that was not fulfilled by supply. Contrary to measures based on firms' use of formal loans (Love and Martinez Peria, 2012; Mudd, 2013), we are able to discriminate between constrained firms and firms that have expressed no demand for loans. According to the definition proposed, one third of firms are rationed (Table 8). Sixty-three percent of firms reported a need for external funds but only 58% of these firms applied. Among the applicants, a large number obtained at least one loan (85%). As documented in Table 1, the credit market experiences differ greatly across developing countries. More than 3 out of 4 firms are rationed in the Democratic Republic of Congo, Angola, Ivory Coast, Mali or Mozambique, but this ratio is below 10% in Hungary and Slovenia.

## 2.2 Measuring bank competition

The purpose of this essay is to investigate the implications of bank competition on credit availability.<sup>4</sup> The choice of the appropriate proxy for interbank competition is therefore crucial. All measures of bank competition are based on bank-level information. The Bankscope database, which covers a large range of banks in the world, is employed to extract balance sheet and income statement information on banks. Computations of indicators of competition are made by World Bank staff and reported in the Global Financial Development Database.

Despite some limitations with the structural approach, the share of assets held by the three largest banks is used as a proxy of the impact of market concentration. We complement the information on bank structure that imperfectly captures bank conduct by using three indicators of competition based on the New Empirical Industrial Organization (NEIO)

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3. It should be noted that surveys do not capture the reason for the refusal. I then assume that all applicants had a rate of return at least equal to the market cost of capital.

4. For a review of advantages and drawbacks of various measures of competition in the banking industry, see Léon (2014).

approach : the Lerner index, the Panzar-Rosse H-statistic, and the Boone indicator. These different measures do not provide the same information about competition, and thus catch different aspects of competition.

The Lerner index is often used in empirical works. It captures the extent to which banks can maintain a price level above their own marginal costs. Greater values of the Lerner index are associated with greater levels of market power. For each individual bank, average revenues proxy price and marginal costs are obtained from the estimation of cost function with three inputs : labor, physical capital and deposits (more details can be found in [Love and Martinez Peria, 2012](#)). The Lerner index for country  $c$  is the weighted (by bank size) average of individual Lerner indices of all banks in country  $c$ . The Lerner index is not a measure of competition but an indicator of market power. [Boone et al. \(2013\)](#) show that the Lerner index at the country level consistently has problems picking up increasing competition due to more aggressive conduct of incumbent firms. The Lerner index is sensitive to the reallocation of activity from inefficient to efficient firms when competition intensifies. This concern is particularly relevant in concentrated markets that encompass the banking industry in many developing countries as documented in Table 1 ([Boone et al., 2013](#)). Furthermore, price cost margins are sensitive to the degree of efficiency ([Koetter et al., 2012](#)) and risk ([Oliver et al., 2006](#)), and therefore macroeconomic conditions ([Carbó-Valverde et al., 2009a](#)). As a consequence, the Lerner index, widely-used in the literature, may be not the most relevant measure of competition. In addition, the Lerner index is available for only 51 countries.

The Panzar-Rosse model is often used to assess the degree of competition in banking. This indicator catches the transmission of input prices, and thus marginal costs, on firms' revenues. [Panzar and Rosse \(1987\)](#) showed that under certain assumptions, the transmission of input price variation differs according to the degree of competition in the market. Weak transmissions are interpreted to indicate the exercise of market power in pricing and higher values indicate more competition. Under perfect competition, an increase in input prices raises both marginal costs and total revenues by the same amount. The elasticity of bank revenues relative to input prices, also called the H-statistic, equals one. In a market where firms collude, an increase in input prices results in a rise in marginal costs, a fall in output, and a decline in revenues, leading to an H-statistic less than or equal

to zero. [Panzar and Rosse \(1987\)](#) and [Vesala \(1995\)](#) show that when the H-statistic lies between 0 and 1, the system is operating under monopolistic competition. The value of the H-statistic is calculated in two steps. First, the logarithm of total revenues is regressed against the logarithm of input prices for each country and other control variables as follows (more details can be found in [Schaeck et al., 2009](#)) :

$$\ln(Rev_{it}) = \alpha + \sum_{l=1}^L \beta_l \ln(w_{l,it}) + \sum_{k=1}^K \gamma_k Z_{k,it} + \mu_i + \varepsilon_{it} \quad (1)$$

where subscripts i, t refers respectively to bank and year. Three inputs ( $w_{l,it}$ ) are considered : labor, physical capital and deposits. The model is run by country over the period 1990-2010 and includes bank fixed effects ( $\mu_i$ ) and control variables ( $Z_{k,it}$ ). Adding the estimated coefficients for each input price in the second step allows us to obtain the value of the H-statistic :

$$H = \sum_{l=1}^3 \beta_l$$

[Claessens and Laeven \(2004\)](#) point out that the Panzar-Rosse model is well-suited to compare competition between markets. An important pitfall, however, concerns identification. The interpretation of the values of the H-statistic requires respecting many assumptions regarding the market equilibrium, demand elasticity, cost structure or exogeneity of input prices ([Bikker et al., 2012](#)). Finally, in this work, an additional limitation comes from data availability. The H-statistic is available for only 35 countries which reduce the sample by half.

[Boone \(2008\)](#) has recently developed a new indicator based on the idea that efficient firms are more rewarded in more competitive markets. The Boone indicator is beginning to be used in banking literature ([Van Leuvensteijn et al., 2011](#); [Delis, 2012](#); [Tabak et al., 2012](#)). The basic intuition underlying this indicator is that more efficient firms achieve superior performance in the sense of higher profit or higher market shares, and that this effect is stronger the heavier the competition is.<sup>5</sup> [Boone et al. \(2007\)](#) shows that the Boone indicator can be calculated as the elasticity of profits to marginal costs. To calculate this elasticity, the log of return on assets is regressed against a log measure of marginal costs.

$$\ln(\pi_i) = \alpha + \beta \ln(MC_i) + \varepsilon_i \quad (2)$$

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5. The same idea was already developed by [Hay and Liu \(1997\)](#).

where  $\pi_i$  stands for profit and  $MC_i$  a measure of marginal cost. Marginal costs are obtained from an estimated translog cost function with three inputs. The more negative the  $\beta$ -coefficient is, the higher the level of competition is in the market. The Boone indicator has two major advantages. On the one hand, it is based on strong theoretical foundations and catches competition due both to a fall in entry barriers and to more aggressive behavior on the part of incumbents. On the other hand, it captures the dynamics and non-price strategy in the market, while the Panzar-Rosse model and Lerner index are based on static price competition. These advantages come with shortcomings. The Boone indicator approach focuses on one important relationship, affected by competition, thereby disregarding other aspects. Efficient gains may not be translated into higher profits in the short-term.

The different indicators employed here catch different aspects of competition. The Lerner index measures the static pricing market power, the Panzar-Rosse H-statistic the transmission of input price changes to revenues, and the Boone indicator the dynamics of markets. Measures of competition differ greatly among countries and are imperfectly correlated. To facilitate the reading of the results, the inverse of the concentration ratio, the Lerner index, and the Boone indicator are used. Thus an increase of the value of the indices is associated with an increase in the level of competition. Finally, it should be noted that indicators of competition are computed at the country level. This may mask subnational differences which may be important for larger countries. Furthermore, the Bankscope data may ignore many small and domestic-owned banks in some countries. We assume that the measures of competition used reflect the real levels of interbank competition in local markets.<sup>6</sup>

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6. A way to overcome this issue would be to proxy the degree of competition for local markets. Employing detailed data on China, [Chong et al. \(2013\)](#) proxy the level of competition in local markets by structure of local markets. However, data requirements associated with this approach are strong. Moreover this approach suffers from limitations associated with the structural approach.

### 3 Empirical methodology

#### 3.1 Impact of competition on credit availability

The first objective of this essay is to evaluate the net impact of bank competition on firms' credit availability. Given the nature of the dependent variable, a binary model is required. The dependent variable is a dummy variable taking the value one if firm  $f$  in country  $c$  is not subject to credit rationing and 0 otherwise. For a binary outcome model, the probability of observing the value 1 (or 0) is conditional to independent variables as follows :

$$y_{fc} = \begin{cases} 1, & \text{if } y_{fc}^* = \alpha + \beta X_{fc} + \varepsilon_{fc} > 0, \\ 0, & \text{if } y_{fc}^* = \alpha + \beta X_{fc} + \varepsilon_{fc} \leq 0 \end{cases}$$

where  $y_{fc}^*$  is the latent variable and  $\varepsilon_{fc}$  is a continuously distributed variable independent of  $X_{fc}$  and the distribution of  $\varepsilon_{fc}$  is symmetric around zero. A binary model is obtained by specifying a functional cumulative distribution function for  $\varepsilon_{fc}$ .

The structure of data considered is a form of panel data with two dimensions : country ( $c$ ) and firm ( $f$ ). It could thus be important to control for unobservable heterogeneity across countries insofar as the interest variable is country-specific. The random effects probit model is used to take into account unobserved country heterogeneity.<sup>7</sup> The model assumes that random errors are divided into two parts :

$$\varepsilon_{fc} = \mu_c + \nu_{fc},$$

where  $\mu_c \sim \mathcal{N}(0, \sigma_\mu^2)$  is the specific country effect and  $\nu_{fc} \sim \mathcal{N}(0, \sigma_\varepsilon^2)$  the pure random effect.

The basic econometric specification estimation through the random effect probit estimator is as follows :

$$Pr(Credit_{fc} = 1) = \Phi(\alpha + \beta Competition_c + \Theta \mathbf{F}_{fc} + \Gamma \mathbf{C}_c) \quad (3)$$

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7. In a non-linear model, including fixed-effects is "technically" possible without removing time-invariant variables. However, this method biases estimated coefficients because of the incidental parameters problem (Wooldridge, 2010). The "fixed-effects" conditional logit model cannot be implemented because it induces a drop of "invariant" variables (all country characteristics including competition here). To test the robustness, we also run a pooled probit model with standard errors clustered at the country level. Results are largely unchanged and often reinforce the conclusion.

where subscripts  $f$  and  $c$  refer to firm and country respectively.  $Credit_{fc}$  is a dummy variable equal to 1 if firm  $f$  in country  $c$  is not credit constrained;  $\mathbf{F}_{fc}$  is the matrix of firm characteristics and  $\mathbf{C}_c$  the matrix of country characteristics.  $Competition_c$  is the indicator of bank competition (concentration ratio, Lerner index, H-statistic or Boone indicator). The net impact of bank competition on credit availability is given by the sign of coefficient  $\beta$ . If  $\beta > 0$  more competition induces less financing constraints in line with the market power hypothesis. By contrast,  $\beta < 0$  confirms the information hypothesis arguing that competition hinders access to finance.

The firm-level variables control for observable firm-level heterogeneity. They include the size and age of the firm, the top manager's years of experience in the firm's sector, and the share of assets held by the largest owner. They also consider dummy variables capturing whether the firm is an exporter, foreign-owned, or government-owned and if the firm was audited in the past year, belongs to a larger firm, is privately held or is listed. Industry dummies are included to control for unobservable characteristics shared by firms in the same sector.

A crucial issue concerns the identification of the net impact of competition. The coefficient associated to competition is biased if this variable captures other characteristics. To overcome the omitted variable issue, country-level characteristics correlated with credit availability and bank competition are included as control variables. The level of economic and financial development are taken into account by adding the logarithm of real GDP per capita and the ratio of domestic credit to GDP. The macroeconomic conditions are captured by the real growth and the inflation rate. The measure of institutional development developed by [Kaufmann et al. \(2010\)](#) is added. Furthermore, the depth of credit information and the strength of legal rights are often advanced to explain differences in both access to finance and competition. We employ the measure of creditors' protection and depth of credit information calculated by Doing Business for each country to control for both. Finally, for judging the potential impact of the current financial crisis, a dummy variable taking value 1 if the survey was implemented between 2009 and 2011 is added. All country-level variables (competition measures included) are measured with one lag. Presentation of variables and summary statistics are presented in Tables 7 and 8.



### 3.2 Disentangling the impact on borrowers and lenders

In the second step, an analysis of determinants of the borrowers decision to apply and the banks approval/denial decision. Until now, the literature has focused on the lender's decision in order to explain the financing gap. This approach is not directly in line with the data. Recent works on developing countries have shown that the low use of formal credit is mainly explained by borrower discouragement rather than banks' denial decisions (Bigsten et al., 2003; Brown et al., 2011; Cole and Dietrich, 2012). In the data used here, 42% of firms with a need for external funds refused to apply, although only 15% of requests were turned down. An advantage of the database is the possibility of investigating to what extend the low incidence of bank credit in developing countries is the result of low credit demand and/or supply-side constraints and factors influencing both.

To investigate the determinants of the decision of a given firm to apply, it is important to control for firms who do not need external financing. Similarly, the bank's decision to approve or deny a request is only available for applicants. A simple probit model is no longer valid due to the sample selection issue (Heckman, 1979). The probit with sample selection (PSS) model proposed by Van de Ven and Van Praag (1981) is thus employed.<sup>8</sup> The PSS model is an extension of the bivariate probit model, which itself is an extension of the univariate probit model. The PSS estimate two probit equations (selection and outcome equations) :

$$\begin{aligned} y_1^* &= x_1\beta_1 + \varepsilon_1 \quad \forall i = 1, \dots, N \quad (\text{Selection equation}) \\ y_2^* &= x_2\beta_2 + \varepsilon_2 \quad \text{if } y_1 = 1 \quad (\text{Outcome equation}) \end{aligned} \quad (4)$$

where error terms follow a bivariate normal distribution :  $(\varepsilon_1, \varepsilon_2) \sim N(0, 0; 1, 1, \rho)$ .<sup>9</sup> The selection equation is completely observed, but we have only a selected sample for the outcome equation.

To our knowledge, the PSS model is only available for pooled estimation (without controlling for country heterogeneity). As a result, the pooled PSS model is used. The relevance of the sample selection problem is tested through a Wald test. Under the null hypothesis,

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8. A common way to the solve sample selection issue consists of including the inverse of the Mills ratio in a two-steps approach. However, Greene (2006) shows that this method is flawed in nonlinear applications.

9.  $E(\varepsilon_1) = 0, E(\varepsilon_2) = 0, Var(\varepsilon_1) = 1, Var(\varepsilon_2) = 1$  and  $Cov(\varepsilon_1, \varepsilon_2) = \rho$

both errors terms are uncorrelated ( $\rho = 0$ ) and therefore the PSS model does not give more information than the simple pooled probit model. Good identification requires that at least one variable is included in the selection equation and does not appear in the outcome equation ( $x_1 = [x_2, z]$ ).

Models are estimated by implementing the the pooled probit with sample selection model. Exclusion variables are presented below and firm- and country-level control variables are the same as previously. To allow correlation across the error terms within a specific country, the standard errors are clustered at the country level for each model.

## 4 Results

### 4.1 Impact of competition on credit availability

This section presents the results of the empirical test of the link between competition and credit availability. Four different proxies of competition are used : the share of assets held by the three largest banks, the Lerner index, the Panzar-Rosse H-statistic, and the Boone indicator. The country pairwise correlations, reported in the Appendix, show that measures of competition are highly correlated with the share of firms that are financially constrained. The proxies for competition are also highly correlated with other country characteristics highlighting the importance of controlling for other country characteristics. Table 2 presents the baseline results using a random effect probit estimator. The first column reports the results of estimation including only firm-level variables. The second column provides the results for a regression without banking sector competition variables. In the following columns, the four different proxies for competition (CR3, Lerner index, Panzar-Rosse H-statistic, and Boone indicator) are included sequentially. The Wald tests show the presence of unobservable country heterogeneity.<sup>10</sup>

Results document that banking competition enhances the financing of firms in developing countries. The coefficient associated to the concentration ratio is not different from zero. Put differently, the structure of the market does not explain the access to credit. The co-

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10. The pooled probit models provide, however, close results regarding the impact of competition proxies both in terms of size and significance.

efficient associated to the Lerner index is not significant at the usual thresholds but it is significant if the threshold is extended to 15%. Despite the fact that studies often employ it, the Lerner index is not the best measure of competition, as discussed above. We therefore also test the relationship between competition and credit availability by considering two other non-structural measures of competition : the Panzar-Rosse H-statistic and the Boone indicator. The coefficients associated to both proxies of competition are positive and significantly different from zero, indicating that firms face lower credit rationing in countries with more competitive markets.

The economic impact of competition is also significant. A one-standard deviation change in the level of interbank competition (Lerner index, Boone indicator or H-statistic) results in a reduction of 2 percentage point in the probability of being rationed. While this may appear to be a small impact, in comparison with other country- and firm-level variables the effect of competition is not insignificant. By comparison, a one standard deviation change in the inflation rate induces a similar change. The fact that a firm is foreign-owned, privately held or has 5 additional employees increases its probability of being constrained by 4 percentage points.

The results for control variables are consistent with expectations. Firms which are larger, foreign-owned, members of a group (subsidiary), audited, and privately held are less likely to suffer from credit rationing. The crisis dummy has a negative coefficient while not always significant. Nonetheless, the economic impact of the crisis is important insofar as the probability of having credit constraints increases by 5 percentage points following 2009. At the country-level, credit binding is related to the economic environment in which firms operate. Credit rationing is more likely in less economically developed countries and in countries with unstable economic environment (high inflation). The coefficient associated to financial development is positive but not always significant. In particular, when unobservable country characteristics are controlled for, it becomes statistically insignificant.

## **4.2 Disentangling the impact on borrowers and lenders**

The baseline set-up shows that competition alleviates credit constraints in developing countries, which is in line with the *market power hypothesis*. In this section, we try

to go one step further by investigating by which channels competition plays a role in facilitating access to finance. Specifically, we try to disentangle the impact of market power on borrowers and lenders.

#### **4.2.1 Impact of bank competition on a firm's decision to apply**

Borrower discouragement can be explained by many economic and non-economic factors (Kon and Storey, 2003). Interbank competition can exert an effect on the borrower's decision to apply for a loan (e.g. rates are reduced, products are more suited or the probability to be approved is higher). In order to analyze the determinants of the decision of a given firm to apply, pooled PSS models are run. Econometric strategy is conditional to the exclusion variables employed. Exclusion variables have to affect the needs for external funds but not directly impact a firm's decision to apply or a bank's willingness to finance. Two variables are used to proxy the need for funds. The proportion of the value of sales paid after the delivery by the customers in the previous year is considered. This variable catches the need of funds for financing working capital. We also add a dummy variable equal to one if the firm submitted an application to obtain a construction permit over the prior two years, approximating the willingness to invest.<sup>11</sup>

Results show that the likelihood of applying for a loan increases with the level of competition. Table 3 presents the determinants of the decision for a given firm with a need for credit to apply or not. The degree of competition is evaluated by employing four different measures (CR3, Lerner index, Boone indicator, and H-statistic). Coefficients associated to the Boone indicator and H-statistic are positive and significant. As in the previous section, the coefficients associated to the share of assets held by the three largest banks

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11. Brown et al. (2011) use the share of working capital financed by retained earnings over the past year. However, one may consider this to be a weak exclusion variable. This variable may be directly related to a firm's decision to apply. A larger share of working capital financed by internal finance does not only reflect a larger credit need but also the difficulty of obtaining these funds from other financing sources. One may expect that firms closely linked to banks finance a larger share of their working capital needs through bank financing but are also less discouraged from applying (because they believe that their request will not be denied). It is interesting to underline that the share of working capital financed by banks is used as a measure of access to credit in the literature (Love et al., 2013). Nonetheless, simple probit models are run to test the robustness of the set of selection variables used.

(CR3) and the Lerner index are not significant at the usual thresholds. Firms in more competitive markets may be less reluctant to apply for a loan. An increase in the Boone indicator or Panzar-Rosse H-statistic by one standard deviation will result in between a 2.3 (Boone) and 3.2 (H-statistic) percentage point rise in the probability of applying. By comparison, an increase of one standard deviation in the level of financial development will induce an increase of 7 percentage points. The positive impact of competition on a firm's decision to apply could be justified by different channels such as lower credit costs, less procedural requirements, well-designed products and services, better access to bank branches or a higher probability of being financed.

Control variables give some other interesting insights. Larger, audited, privately held firms and exporters, as well as firms in which the managers have less experience, are subject to discouragement. The levels of financial and economic development are strongly correlated with a firm's probability of applying for a loan.

#### **4.2.2 Impact of bank competition on a bank's approval decision**

If competitive pressure reduces borrower discouragement, competition can also increase the probability of applicants being financed. Insofar as a bank's final decision is only available for applicants, pooled PSS models are used. A good exclusion variable must impact the likelihood that a firm will apply but should not be observed or taken into account by banks. According to the standard theory, physical capital and labor are, at least partially, related (substitutes or complements). The demand for loans is therefore related to the severity of the obstacles in the labor market perceived by the firm. At the same time, it would be surprising if a lender based its decision on this information (if we suppose that a bank could obtain it). The obstacles in the labor market are measured through a firm's assessment of the severity induced by an inadequately educated workforce on the firm's growth.

Results, reported in Table 4 indicate that the probability of being rejected is lower in countries with more competitive banking markets. The coefficients associated with the Boone indicator and H-statistic are positive and significant at the usual thresholds. The coefficient associated to the Lerner index is positive and significant at 15 percent. Bank concentration is, however, unrelated to the likelihood of applicants being satisfied. Harsher

competition leads to softer loan approval decisions but market structure plays no role.

The economic impact of competition is also significant. An increase of competition by one-standard deviation will raise the probability of being satisfied by one percentage point (for the three non-structural measures of competition). By comparison, an increase of two points in depth information index and legal rights (about one standard deviation) implies an increase in probability of between 1.5 and 2.5 percentage points. The positive effect of competition on a bank's decision to approve or deny is relatively easy to understand. In countries with low levels of competition, a bank can easily turn down an application without cost. By contrast, in competitive markets, the choice to deny implies the risk of losing long-term relationship benefits. Indeed, a denied borrower will contact a rival if it believes that its project is viable. The borrower and rival bank may enter into a long-term relationship and it could be impossible or very costly for outside banks to subsequently attract the firm. Private information may constrain competition in the future ([Sharpe, 1990](#)).

Results regarding the control variables are in line with expectations. Banks are less reluctant to finance transparent firms (larger, older, exporter), or firms linked with a larger one. Following the crisis, banks are less willing to finance firms. The probability of obtaining a loan has been reduced by 3 percentage points in the wake of the crisis. Information sharing mechanisms and creditors protection, despite the lack of net impact on credit availability, have a positive effect on the probability of applicants being financed. In other words, uncertainty and opacity play a significant role in explaining a bank's decision to approve or turn down credit requests.

### **4.3 Relationship lending versus price effect**

The baseline results document the positive effect of competition on credit availability through its impact on borrowers and lenders. However, banking competition can enhance credit availability through increasing relationship lending and/or lowering the interest rate (transaction-based lending technologies). For instance, observing that firms are less reluctant to apply in competitive markets is uninformative. Firms in more competitive markets can apply because credit conditions are more favorable or because they think

they will be approved. In this sub-section, we try to give some insights about this debate. Opaque firms are more likely to benefit from an intensification of relationships rather than from lower prices. If banking competition increases credit availability through expanding relationship lending, we can predict that small and young firms will be impacted more than their counterparts (Chong et al., 2013). We therefore investigate the implications of competition on different sub-groups of firms, classifying them according to their size and age. In this section, the attention is focused on the two measures of competition positively related to credit availability : namely the Panzar-Rosse H-statistic and the Boone indicator. The sample is split according to the size and age of firms. Results, reported in Table 5 Panel A, suggest that smaller firms are not more (or less) affected by competition than larger ones.<sup>12</sup> However, results reported in Panel B show that competition is beneficial mainly for older firms. Both the coefficients associated to Panzar-Rosse H-statistic and Boone indicator show that the youngest firms (less than five years of operations) do not take advantage of fiercer competition. On the contrary, firms established for more than five years benefit more from harsher competition. This suggests that the beneficial effect of competition is larger for well-established than for newly-established firms. Older firms are more sensitive to changes in prices than to increases in relationships. They are more transparent having more assets and a longer credit history. The findings are more in line with the price channel hypothesis. Fierce competition in credit markets may lower interest rate directly or indirectly by softening terms of the loan (collateral requirements, informal payments, etc.).

In order to provide more insight, we investigate in detail the reasons for the refusal to apply. Under the price effect channel, competitive pressure should increase the loan demand for firms reporting high interest rates, collateral requirements or the necessity to make informal payments to justify their decision. By contrast, the demand for loans for firms reporting another reason (satisfaction probability, procedures, etc.) should be less affected by the degree of competition. We then divide discouraged borrowers into firms that justify their choice by price factors and other firms. We investigate the determinants of applications on each sub-sample using the PSS model. The first dependent variable is

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12. Large firms tend to benefit less than SMEs from competition. A possible explanation is the fact that larger firms already have access to finance.

a dummy taken the value of one if the firm applied for a loan and 0 if the firm refused to apply because it considered that the loan terms to be unsatisfactory (other discouraged firms are excluded). The second dependent variable takes the value 0 if the firm refused to apply because they expected to be denied or the procedures were complex. The results are reported in Table 6. The coefficient associated to the Boone indicator is always positive. By contrast, the coefficient associated to the H-statistic is only positive when applicants are compared to discouraged firms that report price factors as a barrier to applying. In other words, this finding shows that competitive pressure mainly increases the likelihood of a firm applying by reducing the direct (interest rates) or indirect (collateral requirements or informal payments) costs of credit. This finding tends to confirm the price channel in line with findings on China ([Chong et al., 2013](#)).

## 5 Robustness checks

One might be concerned about the robustness of the results. Although we control for many country-level variables and use different proxies for competition, other scenarios might explain the positive relationship between competition and credit availability. We will discuss some other potential explanations and show that the results are relatively robust.<sup>13</sup>

In developing countries, the intensification of competition has been accompanied by the globalization process and the expansion of foreign-ownership of banks. Internationalization of banking systems can exert an impact on credit availability. Some papers document that foreign bank presence is associated with higher access to loans for SMEs ([Clarke et al., 2006](#); [Giannetti and Ongena, 2009](#)), while other papers show that foreign banks tend to finance only larger, established and more profitable firms ([Berger et al., 2001](#); [Mian, 2006](#); [Detragiache et al., 2008](#); [Gormley, 2010](#)).<sup>14</sup> Different degrees of competition may merely capture the differences in ownership structure of the banking industry. To test this hypo-

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13. We also run additional robustness checks changing the sample (excluding outliers) and the econometric method (employing pooled probit model) without altering our conclusions regarding the role played by competition.

14. For a review of this question, see : [Claessens and van Horen \(2013\)](#); [Claessens and Van Horen \(2013\)](#).



thesis, we include as controls the share of banking assets owned by foreigners. We use the dataset built by [Claessens and van Horen \(2013\)](#) to proxy the share of banking assets held by foreigners. These variables are only available for 59 countries. The results reported in the Appendix are robust insofar as coefficients associated to competition remain stable in terms of size and significance. The presence of foreign banks tends to play no role on credit availability.

The positive link between competition and access to credit can be explained by financial regulation. Less government interference in the banking system, especially less restrictions on bank activities, may alleviate credit constraints. For instance, in less regulated markets, banks can propose new products more suitable for SME financing. Insofar as competition and financial regulations are correlated, the positive coefficient associated to competition can merely reflect the relationship between financial restrictions and credit availability. To control for this possibility, we include a measure of financial freedom built by the Heritage Foundation. Results highlight that the coefficients associated to competition remain positive and significant. Including activity restrictions based on the World Bank Survey of Bank Regulation and Supervision database ([Barth et al., 2005](#)) instead of the financial freedom variable does not alter the conclusions.<sup>15</sup>

Another potential drawback concerns the measures of competition. The proxies of competition are computed at the country level, while firms borrow locally. Insofar as many banks in developing countries are located in major cities, the degree of competition at the national level tends to reflect the competitive pressure in economic capitals but not the level of competition outside. One might therefore expect that the findings are not valid for firms located outside these cities. The surveys do not provide information about cities where firms are located. However, surveys do give the administrative district in which firms operate. We select a sub-sample of firms located in districts outside economic centers for each country and rerun the model on the sub-sample of firms in remote areas.

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15. In extending the argument, countries with more competitive banking markets are also countries with less restrictions on economic activities beyond banking. Higher facility to borrow can be driven by more "market-friendly" policies and proxies for competition catch this. However, the impact of competition on credit access remain when different proxies for economic freedom are included such as the Economic freedom variable from Heritage Foundation.

The main findings are confirmed.

Finally, it is important to discuss two caveats of the paper. The surveys do not allow us to capture the structure of loans and the dynamics of credit relationships. The paper considers credit as uniform but it is not. Loan terms such as loan rates, loan maturity, collateral requirements or other provisions differ greatly. The data does not allow us to discriminate between different types of credit (e.g. short term vs. long term). In the paper, we merely consider a firm as rationed if the firm has a need for funds but does not use credit. However, a firm with a loan may be considered as rationed if the loan requested differs from the loan granted ([Kirschenmann, 2011](#); [Chong et al., 2013](#)). For example, a firm may apply for a long-term loan and get a short-term credit or may obtain only a share of the total amount desired. We do not believe that this issue alters our study. The measure built in this paper allows us to detect the most financially constrained firms (firms that did not receive credit at all). One may expect that this proxy of strong credit rationing is closely related to partial credit rationing. Competition certainly exerts an effect on both types of credit rationing.

Another concern involves the dynamics of credit. For instance, the data do not allow us to observe borrowers who were rejected in a first attempt but approved in a second attempt (after the survey) or to observe firms that had already applied in the past. Taking into account the dynamics of relationship is crucial in the analysis of credit rationing ([Kirschenmann, 2011](#)). However, the main results are probably not affected by this caveat. For instance, it is possible to expect that the likelihood of denied applicants obtaining credit after the survey would be larger in more competitive countries insofar as harsher competition is associated with softer loan approval decisions. Nonetheless, future research based on different databases could investigate these issues more directly.

## 6 Conclusion

Whether competition helps or hinders small firms' access to finance is in itself a much debated question in the economic literature and in policy circles. Despite the policy relevance of this issue, empirical evidence on the effect of interbank competition on access to finance in developing countries is scarce and largely inconclusive. Using surveys on firms

in developing economies, this paper sheds new light on this debate. A firm is classified as financially rationed only if it expressed a demand for formal funds that was not fulfilled by supply. Furthermore, contrary to existing research, this paper employs several non-structural measures of competition (Lerner index, Boone indicator, or H-statistic) in addition to concentration measures. By confronting the findings from several measures, this paper gives a more complete picture of the role of competition on credit availability. Banking competition can enhance the financing of firms by increasing both the probability that firms apply for loans and that banks do not turn down the applications. As a result, the analysis tries to disentangle the implication of competition between banks on the behavior of firms and of banks.

While the information hypothesis predicts that creditors are more likely to finance credit constrained firms when credit markets are competitive, the evidence from developing countries supports the *market power hypothesis*. Findings, from a sample of almost 30,000 firms in 70 developing countries, show a positive impact of bank competition on credit availability, while bank concentration has no effect. This paper documents that competitive pressure not only leads to less severe loan approval decisions but that it also reduces borrower discouragement. This conclusion is far from anecdotal insofar as the low use of bank credit in developing economies is mainly explained by low demand rather than by high rates of rejection. In addition, the findings tend to show that competition affects credit availability through price effect (lower interest rates) rather than relationship effect (banks invest more in relationship in competitive markets).

The policy implications are twofold. On the one hand, a direct policy implication is to promote competition in credit markets. This may be materialized by developing a large range of pro-competitive measures beyond liberalization. Liberalizing banking sectors may be insufficient insofar as main barriers are non-legal in developing countries (Delis, 2012). For example, developing information sharing mechanisms or facilitating regional integration could spur competition in small markets. However, competitive pressure may be insufficient to provide funds for all firms. A secondary result of this paper documents that banking competition enhances credit availability more by reducing prices than by increasing relationship lending. Consequently, competition in banking is less useful for the most opaque firms, in particular newly-established firms.

Policy makers should also keep in mind that the low use of credit is mainly driven by borrower discouragement. The evidence suggests that a significant portion of discouraged firms would be successful in obtaining credit if only they would apply. Acting on the demand-side is thus crucial if policy makers expect to raise the share of financing of firms by formal financial institutions. Academics should examine in more detail the reasons for borrower discouragement to help the design of effective policies. Discouragement can be justified by both economic and non-economic factors and by both individual and group considerations. Better understanding discouragement in credit markets could be useful in explaining the success and failure of some reforms in these markets. Furthermore, while the paper examines credit constraints from the quantity perspective, it would be interesting to investigate how competition affects loan contract terms, including interest rates, collateral requirements, amount and loan maturity. This may document the debate between the lending relationship and price effect channels but such investigations require new databases.

## Références

- Ayyagari, M., Demirgüç-Kunt, A., and Maksimovic, V. (2008). How important are financing constraints? the role of finance in the business environment. *The World Bank Economic Review*, 22(3) :483–516.
- Barth, J. R., Caprio, G., and Levine, R. (2005). *Rethinking bank regulation : Till angels govern*. Cambridge University Press.
- Baumol, W., Panzar, J., and Willig, R. (1983). Contestable markets : an uprising in the theory of industry structure : reply. *The American Economic Review*, 73(3) :491–496.
- Beck, T. and Demirguc-Kunt, A. (2006). Small and medium-size enterprises : Access to finance as a growth constraint. *Journal of Banking & Finance*, 30(11) :2931–2943.
- Beck, T., Demirguc-Kunt, A., and Maksimovic, V. (2004). Bank competition and access to finance : International evidence. *Journal of Money, Credit, and Banking*, 36(3) :627–648.
- Berger, A. N., Klapper, L. F., and Udell, G. F. (2001). The ability of banks to lend to informationally opaque small businesses. *Journal of Banking & Finance*, 25(12) :2127–2167.
- Besanko, D. and Thakor, A. V. (1992). Banking deregulation : Allocational consequences of relaxing entry barriers. *Journal of Banking & Finance*, 16(5) :909–932.
- Bigsten, A., Collier, P., Dercon, S., Fafchamps, M., Gauthier, B., Gunning, J. W., Oduro, A., Oostendorp, R., Patillo, C., Söderbom, M., et al. (2003). Credit constraints in manufacturing enterprises in Africa. *Journal of African Economies*, 12(1) :104–125.
- Bikker, J. A., Shaffer, S., and Spierdijk, L. (2012). Assessing competition with the Panzar-Rosse model : The role of scale, costs, and equilibrium. *Review of Economics and Statistics*, 94(4) :1025–1044.
- Boone, J. (2008). A new way to measure competition. *The Economic Journal*, 118(531) :1245–1261.

- Boone, J., Van Ours, J., and Wiel, H. v. d. (2007). How (not) to measure competition.
- Boone, J., van Ours, J. C., and van der Wiel, H. (2013). When is the price cost margin a safe way to measure changes in competition ? *De Economist*, pages 1–23.
- Boot, A. and Thakor, A. (2000). Can relationship banking survive competition ? *The journal of Finance*, 55(2) :679–713.
- Broecker, T. (1990). Credit-worthiness tests and interbank competition. *Econometrica : Journal of the Econometric Society*, pages 429–452.
- Brown, M., Ongena, S., Popov, A., and Yeşin, P. (2011). Who needs credit and who gets credit in Eastern Europe ? *Economic Policy*, 26(65) :93–130.
- Carbó-Valverde, S., Humphrey, D., Maudos, J., and Molyneux, P. (2009a). Cross-country comparisons of competition and pricing power in European banking. *Journal of International Money and Finance*, 28(1) :115–134.
- Carbó-Valverde, S., Rodriguez-Fernandez, F., and Udell, G. F. (2009b). Bank market power and SME financing constraints. *Review of Finance*, 13(2) :309–340.
- Cavalluzzo, K. S., Cavalluzzo, L. C., and Wolken, J. D. (2002). Competition, small business financing, and discrimination : Evidence from a new survey. *The Journal of Business*, 75(4) :641–679.
- Cetorelli, N. and Gambera, M. (2001). Banking market structure, financial dependence and growth : International evidence from industry data. *The Journal of Finance*, 56(2) :617–648.
- Chakravarty, S. and Xiang, M. (2013). The international evidence on discouraged small businesses. *Journal of Empirical Finance*, 20(C) :63–82.
- Chong, T. T.-L., Lu, L., and Ongena, S. (2013). Does banking competition alleviate or worsen credit constraints faced by small and medium enterprises ? Evidence from China. *Journal of Banking & Finance*, 37(9) :3412–3424.

- Claessens, S. and Laeven, L. (2004). What drives bank competition ? Some international evidence. *Journal of Money, Credit and Banking*, 36(3) :563–583.
- Claessens, S. and Laeven, L. (2005). Financial dependence, banking sector competition, and economic growth. *Journal of the European Economic Association*, 3(1) :179–207.
- Claessens, S. and van Horen, N. (2013). Foreign banks : Trends and impact. *Journal of Money, Credit, and Banking*.
- Claessens, S. and Van Horen, N. (2013). Impact of foreign banks. *Journal of Financial Perspectives*, 1(1) :29–42.
- Clarke, G. R., Cull, R., and Martínez Pería, M. S. (2006). Foreign bank participation and access to credit across firms in developing countries. *Journal of Comparative Economics*, 34(4) :774–795.
- Cole, R. (2010). Who needs credit and who gets credit ? Evidence from the surveys of Small Business Finances. *MPRA Paper*, 24691.
- Cole, R. and Dietrich, A. (2012). SME credit availability around the World : Evidence from the World Bank’s Enterprise Surveys. In *Midwest Finance Association 2013 Annual Meeting Paper*.
- Cole, R. A. (1998). The importance of relationships to the availability of credit. *Journal of Banking & Finance*, 22(6) :959–977.
- Deidda, L. and Fattouh, B. (2005). Concentration in the banking industry and economic growth. *Macroeconomic Dynamics*, 9(2) :198–219.
- Delis, M. D. (2012). Bank competition, financial reform, and institutions : The importance of being developed. *Journal of Development Economics*, 97(2) :450 – 465.
- Demsetz, H. (1973). Industry structure, market rivalry and public policy. *Journal of Law and Economics*, 16 :1–10.
- Detragiache, E., Tressel, T., and Gupta, P. (2008). Foreign banks in poor countries : theory and evidence. *The Journal of Finance*, 63(5) :2123–2160.

- Ergungor, O. E. (2004). Comment on "bank competition and access to finance : International evidence" by Thorsten Beck, Asli Demirgüç-Kunt, and Vojislav Maksimovic. *Journal of Money, Credit and Banking*, 36(3) :21–23.
- Fernández, A. I., González, F., and Suárez, N. (2010). How institutions and regulation shape the influence of bank concentration on economic growth : International evidence. *International Review of Law and Economics*, 30(1) :28–36.
- Fernández de Guevara, J. and Maudos, J. (2011). Banking competition and economic growth : Cross-country evidence. *The European Journal of Finance*, 17(8) :739–764.
- Giannetti, M. and Ongena, S. (2009). Financial integration and firm performance : Evidence from foreign bank entry in emerging markets. *Review of Finance*, 13(2) :181–223.
- González, V. M. and González, F. (2008). Influence of bank concentration and institutions on capital structure : New international evidence. *Journal of Corporate Finance*, 14(4) :363–375.
- Gormley, T. A. (2010). The impact of foreign bank entry in emerging markets : Evidence from India. *Journal of Financial Intermediation*, 19(1) :26–51.
- Greene, W. (2006). A general approach to incorporating selectivity in a model. *Stern School of Business Working Paper*, 06-10.
- Guzman, M. (2000). Bank structure, capital accumulation, and growth : A simple macroeconomic model. *Economic Theory*, 16(2) :421–455.
- Han, L., Fraser, S., and Storey, D. J. (2009). Are good or bad borrowers discouraged from applying for loans ? evidence from US small business credit markets. *Journal of Banking & Finance*, 33(2) :415–424.
- Hauswald, R. and Marquez, R. (2006). Competition and strategic information acquisition in credit markets. *Review of Financial Studies*, 19(3) :967–1000.
- Hay, D. A. and Liu, G. S. (1997). The efficiency of firms : What difference does competition make ? *The Economic Journal*, 107 :597–617.



- Heckman, J. J. (1979). Sample selection bias as a specification error. *Econometrica : Journal of the econometric society*, pages 153–161.
- Hoxha, I. (2013). The market structure of the banking sector and financially dependent manufacturing sectors. *International Review of Economics & Finance*, 27 :432–444.
- Kaufmann, D., Kraay, A., and Mastruzzi, M. (2010). The Worldwide Governance Indicators : Methodology and analytical issues. *World Bank policy research working paper*, (5430).
- Kirschenmann, K. (2011). Credit rationing in small business bank relationships. mimeo, University of Mannheim.
- Koetter, M., Kolari, J., and Spierdijk, L. (2012). Enjoying the quiet life under deregulation ? evidence from adjusted lerner indices for us banks. *The Review of Economics and Statistics*, 94(2) :462–480.
- Kon, Y. and Storey, D. J. (2003). A theory of discouraged borrowers. *Small Business Economics*, 21(1) :37–49.
- Léon, F. (2014). Measuring competition in banking : A critical review of methods. *CERDI Etudes et Documents*, 12 :1–44.
- Liu, G. and Mirzaei, A. (2013). Industrial growth : Does bank competition, concentration and stability constraints matter ? evidence from developed and developing countries. *Brunel University Working Paper*, 23.
- Love, I. and Martinez Peria, M. (2012). How bank competition affects firms’ access to finance. *World Bank Policy Research Working Paper*, (6163).
- Love, I., Peria, M. S. M., and Singh, S. (2013). Collateral registries for movable assets : Does their introduction spur firms’ access to bank finance ? Technical report, The World Bank.
- Marquez, R. (2002). Competition, adverse selection, and information dispersion in the banking industry. *Review of Financial Studies*, 15(3) :901.

- Mian, A. (2006). Distance constraints : The limits of foreign lending in poor economies. *The Journal of Finance*, 61(3) :1465–1505.
- Mudd, S. (2013). Bank structure, relationship lending and small firm access to finance : A cross-country investigation. *Journal of Financial Services Research*, 44(2) :149–174.
- Oliver, A. M., Fumás, V. S., and Saurina, J. (2006). Risk premium and market power in credit markets. *Economics Letters*, 93(3) :450–456.
- Panzar, J. and Rosse, J. (1987). Testing for "monopoly" equilibrium. *The Journal of Industrial Economics*, XXXV(4) :443–456.
- Petersen, M. A. and Rajan, R. G. (1995). The effect of credit market competition on lending relationships. *The Quarterly Journal of Economics*, 110(2) :407–443.
- Popov, A. and Udell, G. (2012). Cross-border banking, credit access, and the financial crisis. *Journal of International Economics*, 87 :147–161.
- Schaeck, K., Cihák, M., and Wolfe, S. (2009). Are competitive banking systems more stable? *Journal of Money, Credit and Banking*, 41(4) :711–734.
- Sharpe, S. A. (1990). Asymmetric information, bank lending, and implicit contracts : A stylized model of customer relationships. *The Journal of Finance*, 45(4) :1069–1087.
- Tabak, B. M., Fazio, D. M., and Cajueiro, D. O. (2012). The relationship between banking market competition and risk-taking : Do size and capitalization matter? *Journal of Banking & Finance*.
- Van de Ven, W. P. and Van Praag, B. M. (1981). The demand for deductibles in private health insurance : A probit model with sample selection. *Journal of econometrics*, 17(2) :229–252.
- Van Leuvensteijn, M., Bikker, J. A., van Rixtel, A. A., and Sørensen, C. K. (2011). A new approach to measuring competition in the loan markets of the euro area. *Applied Economics*, 43(23) :3155–3167.

Vesala, J. (1995). Testing for competition in banking : Behavioral evidence from Finland.  
*Bank of Finland Studies.*

Wooldridge, J. M. (2010). *Econometric analysis of cross section and panel data*. MIT press.

## 7 Tables

TABLE 1 – Access to finance and interbank competition

Country	% of firms			Interbank competition			
	Rationed	Disc.	Denied	CR3	Lerner	Boone	H-st.
<i>Africa (25 countries)</i>							
Angola	0.81	0.83	0.75	74.60	0.44	-0.14	
Botswana	0.25	0.81	0.23	74.39	0.25	-0.07	
Burundi	0.58	0.73	0.33	100.00		0.05	
Congo	0.52	0.83	0.33	100.00	0.14		
D.R. Congo	0.84	0.88	0.71	61.59		-0.20	
Gabon	0.39	0.86	0.27	96.62		-0.01	
Gambia	0.57	0.86	0.32	90.42		0.02	
Ghana	0.66	0.76	0.36	79.26	0.22	-0.19	
Ivory Coast	0.78	0.86	0.32	59.63	0.24	-0.05	
Lesotho	0.31	0.68	0.30	100.00		0.00	
Liberia	0.44	0.77	0.06	100.00		0.00	
Madagascar	0.39	0.76	0.13	89.72		0.00	
Mali	0.76	0.73	0.66	70.03	0.32	-0.11	
Mauritania	0.76	0.76	0.62	66.89	0.36	0.02	
Mauritius	0.19	0.73	0.19	50.56	0.29	-0.14	
Mozambique	0.72	0.84	0.41	95.62	0.24	-0.04	
Namibia	0.19	0.79	0.31	88.70		0.00	
Rwanda	0.47	0.67	0.22	87.01		-0.06	
Senegal	0.68	0.77	0.47	67.24		-0.07	0.38
Sierra Leone	0.56	0.72	0.18	60.79	0.14	-0.33	
South Africa	0.28	0.78	0.12	70.94	0.29	-0.05	0.87
Swaziland	0.27	0.80	0.16	67.67		-0.23	
Tanzania	0.63	0.78	0.21	55.50	0.28	-0.09	
Uganda	0.56	0.80	0.15	62.99		-0.04	
Zambia	0.43	0.78	0.19	51.92	0.35	-0.10	0.18
<i>Latin America and the Caribbean (16 countries)</i>							
Argentina	0.34	0.66	0.10	43.21	0.29	-0.22	0.49
Bolivia	0.28	0.61	0.08	50.25	0.17	-0.14	0.65
Brazil	0.23	0.46	0.18	49.89	0.36	-0.05	0.75
Chile	0.11	0.41	0.03	54.90	0.30	-0.05	
Colombia	0.16	0.39	0.06	41.39	0.27	-0.02	0.78
Ecuador	0.13	0.44	0.04	48.10		-0.75	0.95
El Salvador	0.20	0.57	0.08	67.50	0.33	-0.07	0.99
Guatemala	0.18	0.69	0.08	48.03	0.19	-0.07	
Honduras	0.23	0.58	0.09	40.75	0.19	-0.05	0.88
Mexico	0.27	0.90	0.16	59.03	0.19	-0.13	
Nicaragua	0.24	0.64	0.09	84.00	0.37	-1.59	
Panama	0.12	0.71	0.02	48.84	0.31	-0.04	0.57

continued on next page

Country	% of firms			Interbank competition			
	Rationed	Disc.	Denied	CR3	Lerner	Boone	H-st.
Paraguay	0.23	0.62	0.05	47.77	0.12	-0.11	0.86
Peru	0.16	0.37	0.03	76.51	0.32	-0.09	0.62
Uruguay	0.34	0.71	0.09	57.57	0.24	0.54	0.78
<i>Europe and Central Asia (26 countries)</i>							
Albania	0.14	0.72	0.01	88.34	0.26	-0.01	
Armenia	0.21	0.58	0.09	43.32	0.31	-0.14	0.76
Azerbaijan	0.44	0.83	0.39	59.70	0.28	-0.08	0.60
Belarus	0.21	0.42	0.09	82.56	0.29	-0.11	0.81
Bosnia	0.27	0.42	0.15	49.32	0.18	-0.04	
Bulgaria	0.25	0.78	0.13	38.73	0.28	-0.51	0.30
Croatia	0.25	0.52	0.18	56.05	0.18	-0.06	0.41
CzechRep	0.15	0.58	0.11	58.69	0.22	-0.09	0.73
Estonia	0.11	0.54	0.12	92.52	0.16	0.04	
Macedonia	0.27	0.62	0.19	70.18	0.21	-0.06	-0.02
Georgia	0.23	0.54	0.13	70.64	0.24	-0.17	0.61
Hungary	0.10	0.69	0.07	53.51	0.19	-0.08	0.66
Kazakhstan	0.28	0.62	0.18	56.00	0.31	0.17	0.57
Latvia	0.22	0.58	0.19	57.60	0.28	0.09	0.90
Lithuania	0.13	0.49	0.10	72.71	0.18	0.15	0.79
Moldova	0.29	0.49	0.19	45.50	0.24	-0.10	0.42
Mongolia	0.35	0.41	0.22	96.93		-0.05	
Montenegro	0.37	0.53	0.14	79.41		-0.09	
Poland	0.20	0.63	0.13	48.68	0.24	-0.09	0.81
Romania	0.17	0.53	0.10	64.37	0.20	-0.10	0.91
Russia	0.27	0.49	0.18	38.84	0.25	-0.04	0.67
Serbia	0.26	0.40	0.19	33.47	0.17	-0.20	0.63
Slovak Rep.	0.16	0.63	0.10	66.02	0.21	0.03	0.59
Slovenia	0.09	0.40	0.09	51.72	0.15	-0.03	0.55
Tajikistan	0.31	0.63	0.17	100.00		0.11	
Turkey	0.15	0.43	0.16	43.94	0.21	-0.02	0.61
Ukraine	0.33	0.62	0.12	26.08	0.22	-0.12	0.69
<i>Others (3 countries)</i>							
Iraq	0.58	0.85	0.49	57.41		0.00	
Laos	0.31	0.88	0.00	88.29		0.17	
SriLanka	0.51	0.77	0.05	54.64		-0.11	

TABLE 2 – Interbank competition and credit availability

	Measure of competition					
	None	None	CR3	Lerner	Boone	H-stat
<i>Firm-level variables</i>						
ln(Firm size)	0.0586*** (17.64)	0.0531*** (18.15)	0.0532*** (18.15)	0.0491*** (15.92)	0.0530*** (18.21)	0.0519*** (15.29)
ln(Age)	0.0070 <sup>†</sup> (1.53)	0.0060 <sup>†</sup> (1.48)	0.0061 <sup>†</sup> (1.48)	0.0065 <sup>†</sup> (1.49)	0.0060 <sup>†</sup> (1.47)	0.0036 (0.73)
ln(Exp)	-0.0013 (-0.28)	-0.0015 (-0.37)	-0.0015 (-0.36)	-0.0027 (-0.58)	-0.0015 (-0.37)	-0.0068 (-1.30)
Largest ow.	-0.0000 (-0.38)	-0.0000 (-0.43)	-0.0000 (-0.43)	-0.0001 (-1.06)	-0.0001 (-0.49)	-0.0002 <sup>†</sup> (-1.60)
For.-owned	0.0393*** (3.85)	0.0367*** (4.00)	0.0366*** (3.98)	0.0354*** (3.48)	0.0365*** (4.00)	0.0202* (1.67)
Gov.-owned	-0.0576 <sup>†</sup> (-1.47)	-0.0497 (-1.40)	-0.0500 (-1.41)	-0.0469 (-1.23)	-0.0466 (-1.32)	-0.0666 <sup>†</sup> (-1.49)
Exporter	0.0104 (1.12)	0.0087 (1.04)	0.0088 (1.05)	0.0119 (1.39)	0.0088 (1.05)	0.0147 <sup>†</sup> (1.60)
Subsidiary	0.0499*** (5.56)	0.0449*** (5.56)	0.0449*** (5.55)	0.0439*** (5.10)	0.0444*** (5.52)	0.0398*** (4.06)
Audited	0.0530*** (7.90)	0.0476*** (7.88)	0.0477*** (7.87)	0.0382*** (5.95)	0.0474*** (7.87)	0.0279*** (3.85)
Publicly listed	0.0057 (0.37)	0.0055 (0.40)	0.0056 (0.41)	0.0040 (0.28)	0.0059 (0.43)	0.0047 (0.29)
Privately held	0.0429*** (5.59)	0.0384*** (5.50)	0.0386*** (5.51)	0.0329*** (4.49)	0.0382*** (5.49)	0.0274*** (3.23)
Crisis	-0.0501* (-1.80)	-0.0565** (-2.43)	-0.0586** (2.47)	-0.0788*** (-3.03)	-0.0487** (-2.10)	-0.0258* (-1.74)
<i>Country-level variables</i>						
<b>Competition</b>			<b>-0.0003 (-0.51)</b>	<b>0.3043<sup>†</sup> (1.48)</b>	<b>0.0967* (1.86)</b>	<b>0.1197* (1.86)</b>
Fin. Dev.		0.0005 (0.74)	0.0006 (0.76)	0.0005 (0.67)	0.0005 (0.69)	0.0001 (0.15)
ln(GDPpc)		0.0768*** (3.91)	0.0799*** (3.89)	0.0714*** (3.21)	0.0797*** (4.12)	0.0407 <sup>†</sup> (1.46)
Growth		0.0007 (0.23)	0.0008 (0.23)	-0.0049 (-1.05)	0.0012 (0.37)	0.0000 (0.00)
Inflation		-0.0022* (-1.88)	-0.0022* (-1.90)	-0.0019 (-1.61)	-0.0023** (-1.99)	-0.0062** (-2.17)
Legal Rights		0.0052 (0.83)	0.0059 (0.92)	0.0114* (1.75)	0.0042 (0.68)	0.0057 (0.81)
Credit Info		0.0041 (0.49)	0.0045 (0.53)	0.0109 (1.22)	0.0012 (0.15)	0.0047 (0.51)
Inst. Dev.		0.0007 (0.02)	-0.0037 (-0.10)	-0.0138 (-0.38)	0.0087 (0.25)	-0.0207 (-0.38)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
# firms	28949	28949	28949	23550	28929	17755
# Countries	70	70	70	51	69	35
LR test	2517.08***	1095.28***	1093.27***	740.62***	1025.29***	338.15***

The dependent variable is a dummy equals to 1 if the firm is not subject to financing rationing. Inverse of CR3, Lerner index and Boone indicator are used in the table. The LR test compares the pooled estimator (probit) with the panel estimator. Under null hypothesis, the panel estimator is not different from the pooled estimator. MEs are reported, and z-statistics are presented in parentheses. Standard errors are adjusted for clustering at the country-level. <sup>†</sup>, \*, \*\*, and \*\*\* indicate significance at the 15%, 10%, 5% and 1% respectively.

TABLE 3 – Interbank competition and loan applications

	Measure of competition					
	None	None	CR3	Lerner	Boone	Hstat
<i>Firm-level variables</i>						
ln(Firm size)	0.0814*** (12.49)	0.0782*** (12.69)	0.0782*** (12.66)	0.0742*** (10.42)	0.0781*** (12.76)	0.0786*** (18.08)
ln(Age)	-0.0035 (-0.42)	-0.0120† (-1.62)	-0.0120† (-1.64)	-0.0091 (-1.14)	-0.0134* (-1.89)	-0.0207*** (-2.64)
ln(Exp)	0.0365*** (3.84)	0.0151** (2.13)	0.0151** (2.11)	0.0115* (1.77)	0.0131* (1.91)	0.0036 (0.57)
Largest ow.	-0.0002 (-0.61)	-0.0002 (-0.72)	-0.0002 (-0.74)	-0.0002 (-1.00)	-0.0002 (-0.95)	-0.0003† (-1.48)
For.-owned	-0.0544*** (-3.33)	-0.0131 (-1.27)	-0.0126 (-1.21)	-0.0100 (-0.84)	-0.0145 (-1.39)	-0.0096 (-0.81)
Gov.-owned	-0.1076 (-1.40)	-0.0625 (-0.99)	-0.0614 (-0.97)	-0.0527 (-0.70)	-0.0584 (-0.92)	-0.0561 (-0.70)
Exporter	0.0654*** (3.94)	0.0484 (3.36)	0.0483*** (3.36)	0.0471*** (3.39)	0.0476*** (3.30)	0.0460*** (3.79)
Subsidiary	-0.0042 (-0.33)	-0.0063 (-0.45)	-0.0065 (-0.47)	-0.0064 (-0.45)	-0.0048 (-0.35)	-0.0073 (-0.47)
Audited	0.0717*** (4.42)	0.0641*** (4.25)	0.0640*** (4.15)	0.0554*** (3.31)	0.0655*** (4.32)	0.0463*** (4.28)
Publicly listed	0.0734** (2.45)	0.0412† (1.57)	0.0410† (1.56)	0.0049 (0.21)	0.0411† (1.61)	-0.0029 (-0.11)
Privately held	0.1305*** (5.21)	0.0783*** (4.23)	0.0780*** (4.21)	0.0557*** (3.72)	0.0777*** (4.44)	0.0441*** (3.05)
Crisis	0.0328 (0.95)	-0.0084 (-0.26)	-0.0087 (-0.26)	0.0210 (0.66)	0.0006 (0.02)	0.0907*** (2.74)
<i>Country-level variables</i>						
<b>Competition</b>			<b>0.0001 (0.08)</b>	<b>0.0794 (0.38)</b>	<b>0.0974** (2.08)</b>	<b>0.1441** (2.32)</b>
Fin. Dev.		0.0033*** (2.65)	0.0033*** (2.65)	0.0025** (2.16)	0.0032*** (2.66)	0.0009 (0.86)
ln(GDPpc)		0.0504** (2.22)	0.0499** (2.11)	0.0464* (1.72)	0.0543** (2.30)	0.0613* (1.72)
Growth		-0.0004 (-0.09)	-0.0004 (-0.08)	-0.0066 (-1.03)	0.0002 (0.04)	-0.0028 (-0.35)
Inflation		-0.0011 (-1.24)	-0.0011 (-1.21)	-0.0012 (-1.44)	-0.0012 (-1.50)	-0.0116*** (-4.36)
Legal Rights		-0.0077 (-1.08)	-0.0080 (-1.02)	-0.0076 (1.02)	-0.0091 (-1.31)	0.0051 (0.57)
Credit Info		0.0038 (0.44)	0.0040 (0.46)	0.0015 (0.17)	0.0004 (0.05)	-0.0083 (-1.32)
Inst. Dev.		-0.0251 (-0.68)	-0.0242 (-0.61)	-0.0252 (-0.57)	-0.0135 (-0.40)	-0.1499** (-1.93)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
# firms	18238	18238	18238	14572	18225	10978
# Countries	70	70	70	51	69	35
Wald test ( $\rho = 0$ )	162.71***	70.92***	74.49***	0.57	69.27**	20.75***

The dependent variable is a dummy equals to 1 if the firm with a need for funds applied. Inverse of CR3, Lerner index and Boone indicator are used in the table. Probit with sample selection (PSS) issue is used. The Wald test compares the pooled estimator (probit) with the PSS model. Under null hypothesis, the PSS estimator is not different from the pooled estimator. MEs are reported, and z-statistics are presented in parentheses. Standard errors are adjusted for clustering at the country-level. †, \*, \*\* and \*\*\* indicate significance at the 15%, 10%, 5% and 1% respectively.

TABLE 4 – Interbank competition and loan rejection/acceptation

	Measure of competition					
	None	None	CR3	Lerner	Boone	Hstat
<i>Firm-level variables</i>						
ln(Firm size)	0.0089*** (3.31)	0.0091*** (3.54)	0.0091*** (3.56)	0.0091*** (3.86)	0.0093*** (3.68)	0.0091** (2.04)
ln(Age)	0.0208*** (5.59)	0.0197*** (5.71)	0.0198*** (5.69)	0.0182*** (4.89)	0.0188*** (5.67)	0.0162*** (3.44)
ln(Exp)	0.0064† (1.47)	0.0009 (0.22)	0.0012 (0.28)	0.0019 (0.48)	0.0003 (0.08)	-0.0069 (-1.23)
Largest ow.	-0.0000 (-0.13)	0.0000 (0.19)	0.0000 (0.15)	0.0001 (0.76)	0.0000 (.0.08)	-0.0000 (-0.37)
For.-owned	0.0107 (1.16)	0.0197** (2.02)	0.0192** (2.07)	0.0121 (1.17)	0.0190* (1.95)	0.0057 (0.51)
Gov.-owned	-0.0090 (-0.33)	0.0066 (0.29)	0.0054 (0.24)	0.0030 (0.14)	0.0074 (0.33)	-0.0313 (-1.33)
Exporter	-0.0099 (-1.14)	-0.0156* (-1.85)	-0.0156* (-1.85)	-0.0138* (-1.75)	-0.0158* (-1.87)	-0.0098 (-1.32)
Subsidiary	0.0203*** (2.66)	0.0202*** (2.83)	0.0200*** (2.80)	0.0205*** (3.05)	0.0197*** (2.79)	0.0169** (2.42)
Audited	0.0027 (0.38)	-0.0009 (-0.14)	-0.0013 (-0.19)	-0.0079 (-1.21)	-0.0004 (-0.06)	-0.0088 (-1.20)
Publicly listed	0.0146 (1.17)	0.0080 (0.60)	0.0086 (0.64)	0.0182† (1.48)	0.0074 (0.55)	0.0165 (1.31)
Privately held	0.0333*** (3.00)	0.0173** (2.07)	0.0180** (2.10)	0.0209*** (2.73)	0.0174** (2.12)	0.0052 (0.67)
Crisis	-0.0342** (-2.43)	-0.0464*** (-3.37)	-0.0467*** (-3.38)	-0.0630*** (-5.12)	-0.0434*** (-3.14)	-0.0421*** (-3.01)
<i>Country-level variables</i>						
<b>Competition</b>			<b>-0.0002 (-0.50)</b>	<b>0.1242† (1.51)</b>	<b>0.0323** (2.30)</b>	<b>0.0442** (2.04)</b>
Fin. Dev.		0.0002 (0.63)	0.0002 (0.63)	0.0002 (0.60)	0.0002 (0.59)	0.0009* (1.79)
ln(GDPpc)		0.0047 (0.46)	0.0065 (0.54)	0.0035 (0.32)	0.0055 (0.53)	-0.0036 (-0.32)
Growth		0.0001 (0.06)	0.0001 (0.04)	-0.0022 (-0.83)	0.0003 (0.13)	0.0051* (1.79)
Inflation		-0.0007 (-1.20)	-0.0007 (-1.20)	-0.0002 (-0.56)	-0.0007 (-1.32)	-0.0032** (-1.98)
Legal Rights		0.0078*** (2.58)	0.0081** (2.31)	0.0097*** (3.04)	0.0074** (2.46)	0.0066** (1.98)
Credit Info		0.0116*** (3.59)	0.0116*** (3.53)	0.0141*** (4.26)	0.0108*** (3.18)	0.0128*** (4.21)
Inst. Dev.		-0.0101 (-0.59)	-0.0128 (-0.64)	-0.0095 (-0.63)	-0.0071 (-0.41)	-0.0351 (-1.22)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
# firms	10597	10597	10597	9027	10592	7461
# Countries	70	70	70	51	69	35
Wald test ( $\rho = 0$ )	2.71*	6.42**	5.89**	12.45***	7.76***	1.93

The dependent variable is a dummy equals to 1 if the applicant received a loan (and 0 otherwise). Inverse of CR3, Lerner index and Boone indicator are used in the table. Probit with sample selection (PSS) issue is used. The Wald test compares the pooled estimator (probit) with the PSS model. Under null hypothesis, the PSS estimator is not different from the pooled estimator. MEs are reported, and z-statistics are presented in parentheses. Standard errors are adjusted for clustering at the country-level. †, \*, \*\* and \*\*\* indicate significance at the 15%, 10%, 5% and 1% respectively.

TABLE 5 – Interbank competition and credit availability, by firm size and age

<i>Panel A : Firm size</i>						
	Boone indicator			H-statistic		
	Small	Medium	Large	Small	Medium	Large
Competition	0.1143* (1.88)	0.1053* (1.94)	0.0533 <sup>†</sup> (1.41)	0.1267* (1.65)	0.1176* (1.92)	0.0878* (1.86)
Firm controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Country controls	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	15513	5981	7435	8430	3969	5356
# Countries	69	69	69	35	35	35
LR test	616.27***	141.83***	88.51***	204.53***	30.33***	25.90***

  

<i>Panel B : Firm age</i>						
	Boone indicator			H-statistic		
	Young	Medium	Old	Young	Medium	Old
Competition	0.0758 (1.06)	0.1057* (1.91)	0.1088** (2.43)	0.1087 (1.24)	0.1007* (1.64)	0.1130* (1.78)
Firm controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Country controls	Yes	Yes	Yes	Yes	Yes	Yes
# firms	4772	12795	11362	2405	7914	7436
# Countries	69	69	69	35	35	35
LR test	175.80***	363.01***	274.83***	38.96***	83.51***	111.30***

The dependent variable is a dummy equals to 1 if the firm is not subject to financing rationing. Small-sized firms are less than 20 employees, medium-sized have more than 20 employees but less than 50 and large firms, and large firms have more than 50 employees. Young firms assemble firms operate for less than five years and old firms are firms with more than 15 years of operations. Inverse of Boone indicator is used in the table. The LR test compares the pooled estimator (probit) with the panel estimator. Under null hypothesis, the panel estimator is not different from the pooled estimator. MEs are reported, and z-statistics are presented in parentheses. Standard errors are adjusted for clustering at the country-level. <sup>†</sup>, \*, \*\* and \*\*\* indicate significance at the 15%, 10%, 5% and 1% respectively.



TABLE 6 – Interbank competition and loan applications, by reasons

	Boone indicator		H-statistic	
	Price	Other	Price	Other
Competition	0.0540*	0.0458**	0.1308***	.0138
	(1.66)	(2.22)	(3.43)	(0.39)
Firm controls				
Industry FE				
Country controls				
# firms	15487	13330	9729	8710
# Countries	69	69	35	35
Wald test ( $\rho = 0$ )	66.30***	37.04***	38.74***	7.72***

The *Price* variable is a dummy equals to 1 if the applicant received a loan and 0 if the firm refused to apply owing to contract term consideration (e.g. interest rates or collateral requirements). The *Other* variable is a dummy equals to 1 if the applicant received a loan and 0 if the firm refused to apply due to other consideration (e.g. expected that demand will be turned down). Inverse of Boone indicator is used in the table. Probit with sample selection (PSS) issue is used. The Wald test compares the pooled estimator (probit) with the PSS model. Under null hypothesis, the PSS estimator is not different from the pooled estimator. MEs are reported, and z-statistics are presented in parentheses. Standard errors are adjusted for clustering at the country-level. \*, \*\*, and \*\*\* and indicate significance at the 10%, 5% and 1% respectively.

TABLE 7 – Variables description and data source

Variable	Description	Source
<u>Dependent variables</u>		
Credit	Dummy variable equals to 0 if the firm is classified as <i>Discouraged</i> or as <i>Denied</i> and 1 otherwise	WBES <sup>a</sup>
Need	Dummy variable equals to 1 if the firm needed external funds in the last year	WBES
Apply	Dummy variable equals to 1 if the firm needed external funds and applied for loans and 0 if the firm did not apply	WBES
Accepted	Dummy variable equals to 1 if the firm applied for loans and received at least one line of credit and 0 if the firm applied but did not receive a line of credit	WBES
<u>Independent variables</u>		
<u>Interbank competition</u>		
CR3	Share of banking system assets held by the three largest banks	GFDD <sup>b</sup>
Lerner	Value of the Lerner index	GFDD
Boone	Value of the Boone index	GFDD
H-stats	Value of the H-statistics	GFDD
<u>Firm-level control variables</u>		
Firm size	Number of permanent full-time employees	WBES
Age	Age of the firms (in years)	WBES
Exporter	Dummy variable equals to 1 if 10% or more of sales are exported	WBES
Foreign-owned	Dummy variable equals to 1 if 50% or more of the firm is owned by foreign organization	WBES
Government-owned	Dummy variable equals to 1 if 50% or more of the firm is owned by the government	WBES
Experience	Experience in this sector that the top manager has (in years)	WBES
Largest owner	Share of assets held by the largest owner	WBES
Audited	Dummy variable equals to 1 if the firm have its annual financial statement checked and certified by an external auditor	WBES
Subsidiary	Dummy variable equals to 1 if the firm is part of larger firm	WBES
Publicly listed	Dummy variable equals to 1 if the firms is a publicly listed company	WBES
Privately held	Dummy variable equals to 1 if the firms is a limited liability company	WBES
<u>Country-level control variables</u>		
Financial Development	Domestic credit to the private sector to GDP	GFDD
GDPpc	GDP per capita (Constant USD)	WDI <sup>c</sup>
Inflation	Annual change in the GDP deflator	WDI
Growth	Real growth of the GDP	WDI
Credit information	Depth of credit information index is a measure of the coverage, scope and accessibility of credit information available through either a public credit registry or a private credit bureau (0-6)	DB <sup>d</sup>
Legal Rights	The strength of legal rights index measures the degree to which collateral and bankruptcy laws protect the rights of borrowers and lenders (0-10)	DB
Institution Dev.	Composite index of institutional development	WGI <sup>e</sup>
Crisis	Dummy variable equals to 1 if year $\geq 2009$	
<u>Selection variables</u>		
WK	Proportion of goods or services paid for after the delivery	WBES
Construction	Dummy variable equals to 1 if the firm submit an application to obtain a construction-related permit over the last two years	WBES
Obstacles	Firm's assessment of growth obstacle induced by an inadequately educated workforce (ranges from 0 (no obstacle) to 4)	WBES

<sup>a</sup>WBES : World Bank Enterprises Surveys ; <sup>b</sup> GFDD : Global Financial Development Database ; <sup>c</sup> WDI : World Development Indicators <sup>d</sup> DB : Doing Business ; <sup>e</sup> WGI : World Governance Indicators

TABLE 8 – Summary Statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
<i>Independent variables</i>					
Credit	28952	0.6813	0.4660	0	1
Need	28952	0.6300	0.4828	0	1
Apply	18238	0.5810	0.4934	0	1
Accepted	10598	0.8504	0.3567	0	1
<i>Dependent variables</i>					
<i>Firm-level variables</i>					
Firm size	28952	77.9750	237.524	0	5000
Age	28952	16.9504	14.9103	0	108
Experience	28952	17.2560	11.1765	0	75
Largest owner	28952	78.2017	26.7016	0	100
Foreign-owned	28952	0.1001	0.3001	0	1
Gov.-owned	28952	0.0057	0.0757	0	1
Exporter	28952	0.1390	0.3460	0	1
Subsidiary	28952	0.1286	0.3348	0	1
Audited	28952	0.4753	0.4993	0	1
Publicly listed	28952	0.0515	0.2211	0	1
Privately held	28952	0.5847	0.4928	0	1
Construction	28952	0.1606	0.3671	0	1
WK	28952	48.5730	39.9079	0	100
Obstacles	28952	1.5163	1.3590	0	4
<i>Country-level variables</i>					
CR3	70	65.4999	19.1019	26.08	100
Lerner	51	0.2482	0.0691	0.12	0.44
Boone	69	-0.0900	0.2376	-1.59	0.54
H-stat	35	0.6500	0.2203	-0.02	0.99
Fin. Dev.	70	30.6170	23.0935	1.56	95.97
GDPpc	70	2647.21	2701.75	92.37	13836
Growth	70	5.7105	3.9012	-4.24	21.71
Inflation	70	10.4114	10.7748	-1.74	80.75
Legal rights	70	5.1285	2.3089	1	10
Credit Info	70	3.1745	2.1629	0	6
Institution Dev.	70	-0.2309	0.6217	-1.61	1.14

TABLE 9 – Pairwise correlations

	% of firms			CR3	Lerner	Boone	H-St.	Fin. Dev.	GDPpc	Gr.	Infl.	Legal rights	Credit Info	Inst. Dev.
	Credit	App.	Acc.											
Credit Av.	1.00													
Apply	0.84	1.00												
Accepted	0.80	0.62	1.00											
CR3	0.23	0.31	0.21	1.00										
Lerner	0.20	0.25	0.35	0.09	1.00									
Boone	0.06	0.05	0.04	0.10	-0.21	1.00								
H-st	0.28	0.34	0.41	-0.02	0.04	-0.06	1.00							
Fin. Dev.	0.55	0.62	0.36	0.24	0.16	-0.09	0.12	1.00						
GDPpc	0.68	0.67	0.49	0.38	0.19	-0.09	0.22	0.65	1.00					
Growth	-0.10	-0.14	-0.10	-0.08	-0.36	0.02	-0.09	-0.37	-0.34	1.00				
Inflation	-0.38	-0.32	-0.39	-0.16	-0.04	0.05	-0.05	-0.23	-0.32	0.15	1.00			
Legal rights	0.33	0.21	0.23	0.19	0.08	-0.05	-0.09	0.41	0.30	-0.15	-0.07	1.00		
Credit Info.	0.58	0.58	0.42	0.35	0.05	0.07	0.41	0.46	0.72	-0.15	-0.29	0.04	1.00	
Inst. Dev	0.52	0.56	0.35	0.17	0.14	-0.15	0.01	0.72	0.72	-0.35	-0.24	0.50	0.45	1.00

Pairwise correlations computed at the national level. Inverse of CR3, Lerner index and Boone indicator are used in the table.

TABLE 10 – Robustness checks

*Panel A : Foreign banks ownership*

	Dependent variable : Credit availability				Dependent variable : Apply				Dependent variable : Accepted			
	CR3	Lerner	Boone	H-st.	CR3	Lerner	Boone	H-st.	CR3	Lerner	Boone	H-st.
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]
Competition	0.0002 (0.24)	0.1872 (0.85)	0.1070** (2.16)	0.1197* (1.82)	0.0002 (0.24)	0.0600 (0.29)	0.0952** (2.26)	0.1388** (2.24)	0.0002 (0.58)	0.0868 (0.96)	0.0379** (2.44)	0.0419** (2.17)
Foreign bank assets	0.0005 (0.82)	-0.0345 (-0.85)	0.0006 (1.02)	0.0001 (0.10)	-0.0001 (-0.10)	-0.0002 (-0.22)	0.0000 (0.01)	-0.0002 (-0.25)	0.0003 (0.86)	0.0007** (2.08)	0.0003 (0.89)	0.0004 (0.92)
# Firms	26906	23172	26886	17434	16812	14282	16799	10733	10001	8804	9996	7262
# Countries	59	49	58	34	59	49	58	34	59	49	58	34
LR test	900.52***	733.26***	820.53***	336.92***								
Wald test ( $\rho = 0$ )					54.44***	12.76***	52.38***	26.51***	16.36***	17.18***	17.28***	1.38

*Panel B : Financial freedom*

	Credit availability				Application for loans				Satisfied or denied ?			
	CR3	Lerner	Boone	H-st.	CR3	Lerner	Boone	H-st.	CR3	Lerner	Boone	H-st.
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]
Competition	-0.0004 (-0.48)	0.3509* (1.75)	0.0887* (1.70)	0.1258** (2.26)	0.0002 (0.23)	0.1210 (0.59)	0.0766* (1.79)	0.1432*** (2.79)	-0.0001 (-0.34)	0.1457* (1.86)	0.0261* (1.66)	0.0469** (1.99)
Fin Freedom	0.0012 (1.18)	0.0019* (1.84)	0.0008 (0.84)	0.0033*** (3.36)	0.0023* (1.88)	0.0026* (1.79)	0.0021 <sup>†</sup> (1.61)	0.0042*** (3.30)	0.0011** (2.34)	0.0011** (2.04)	0.0009** (2.08)	0.0009* (1.81)
# Firms	28046	23550	28026	17755	17579	14572	17566	10978	10464	9027	10459	7461
# Countries	68	51	67	35	68	51	67	35	68	51	67	35
LR test	921.20***	611.69***	878.77***	205.94***								
Wald test ( $\rho = 0$ )					79.61***	7.47***	67.95***	28.99***	5.07**	9.38***	6.08**	2.38

Credit availability is dummy equals to 1 if the firm is not subject to financing rationing. Apply is a dummy equals to 1 if the firm with a need for funds applied. Accepted is a dummy equals to 1 if the applicant received a loan. Inverse of CR3, Lerner index and Boone indicator are used in the table. Models [1]-[4] are estimated by running random-effect probit model. The LR test compares the pooled estimator (probit) with the panel estimator. Under null hypothesis, the panel estimator is not different from the pooled estimator. Models [5]-[12] are estimated by running pooled PSS model. The Wald test compares the pooled estimator (probit) with the PSS model. Under null hypothesis, the PSS estimator is not different from the pooled estimator. All models include firm- and country-level control variables and industry-dummies. MEs are reported, and z-statistics are presented in parentheses. Standard errors are adjusted for clustering at the country-level. <sup>†</sup>, \*, \*\*, and \*\*\* and indicate significance at the 15%, 10%, 5% and 1% respectively.

TABLE 11 – Robustness checks

*Panel C : Sub-sample on firms in non-economic centers*

	Credit availability				Application for loans				Satisfied or denied ?			
	CR3 [1]	Lerner [2]	Boone [3]	H-st. [4]	CR3 [5]	Lerner [6]	Boone [7]	H-st. [8]	CR3 [9]	Lerner [10]	Boone [11]	H-st. [12]
Competition	-0.0009 (-1.08)	0.1276 (0.60)	0.0976* (1.77)	0.1504** (2.37)	-0.0006 (-0.56)	-0.1286 (-0.59)	0.0622 <sup>†</sup> (1.60)	0.2015*** (3.86)	-0.0003 (-1.08)	0.0548 (0.58)	-0.0356 <sup>†</sup> (1.54)	0.0852*** (3.37)
# Firms	14341	12016	14332	9708	8982	7471	8975	6154	5539	4852	5535	4252
# Countries	68	51	67	35	68	51	67	35	68	51	67	35
LR test	461.46***	304.87***	455.49***	99.63***								
Wald test ( $\rho = 0$ )					23.93***	0.53	29.96***	52.22***	2.76*	7.42***	3.10*	1.69

Credit availability is dummy equals to 1 if the firm is not subject to financing rationing. Apply is a dummy equals to 1 if the firm with a need for funds applied. Accepted is a dummy equals to 1 if the applicant received a loan. Inverse of CR3, Lerner index and Boone indicator are used in the table. Models [1]-[4] are estimated by running random-effect probit model. The LR test compares the pooled estimator (probit) with the panel estimator. Under null hypothesis, the panel estimator is not different from the pooled estimator. Models [5]-[12] are estimated by running pooled PSS model. The Wald test compares the pooled estimator (probit) with the PSS model. Under null hypothesis, the PSS estimator is not different from the pooled estimator. All models include firm- and country-level control variables and industry-dummies. MEs are reported, and z-statistics are presented in parentheses. Standard errors are adjusted for clustering at the country-level. <sup>†</sup>, \*, \*\*, and \*\*\* and indicate significance at the 15%, 10%, 5% and 1% respectively.